

AMENDMENTS TO THE CLAIMS

A complete listing of the claims follows. Please amend claim 53 as indicated below. All other claims remain as originally presented.

53. (Currently amended) A semiconductor wafer fabrication system comprising:

a sealed chamber for processing said semiconductor wafer having a first surface and a second surface; and a head assembly comprising:

a modulated light source exposing at least a portion of said semiconductor wafer to light having a wavelength and modulated at a frequency;

a surface photovoltage sensor comprising a plurality of electrodes positioned adjacent said first surface to detect a surface photovoltage induced at said first surface of said semiconductor wafer in response to said light without contacting said wafer, said plurality of electrodes sufficient for detecting said surface photovoltage on said first surface;

said surface photovoltage sensor of said head assembly located within said sealed chamber; and

a conveying apparatus conveying said wafer adjacent said voltage sensor of the head assembly under the head assembly during processing.

54. (Original) The semiconductor wafer fabrication system of claim 53 wherein said sealed chamber is a reduced pressure chamber.

55. (Original) The semiconductor wafer fabrication system of claim 53 wherein said sealed chamber is a chemically reactive gas chamber.

56. (Original) The semiconductor wafer fabrication system of claim 53 wherein said sealed chamber is an inert environment chamber.
57. (Original) The semiconductor wafer fabrication system of claim 53 wherein said head assembly is entirely located within said sealed chamber.

RESPONSE

Applicants note that a duplicate Office Action was sent in connection with this patent application. One Office Action was mailed on February 4, 2004 and the identical Office Action was re-sent on February 25, 2004. After a phone call to the Examiner, Applicants were advised that the February 25, 2004 Office Action was controlling.

The Office Action has been carefully considered and the following remarks are made in response hereto. Claims 53-57 are pending in the application. Claims 53-57 stand rejected under 35 USC §103(a). Applicants respectfully traverse this basis of rejection. The present Amendment and Response amends claim 53. Upon entry of the present Amendment and Response, claims 53-57 are pending and presented for reconsideration.

Claim Amendment and Relevant Support

Claim 53 has been amended to recite in part “a conveying apparatus conveying said wafer adjacent said voltage sensor of the head assembly under the head assembly during processing.” Applicants submit that no new matter is introduced. Support for the foregoing amendment may be found in the Specification at, for example, page 4, lines 14-16; and Fig. 2.

Rejection of Claims Over of Kamieniecki in View of Yoshino

Claims 53-57 stand rejected under 35 USC 103(a) as being unpatentable over Kamieniecki et al (5,091,691), (“Kamieniecki”) in view of Yoshino et al (5,708,365), (“Yoshino”).

As amended, claim 53, in part, requires the movement of a wafer under a head in a sealed processing chamber during processing.

A semiconductor wafer fabrication system comprising: a sealed chamber for processing said semiconductor wafer having...a head assembly comprising...a surface photovoltage sensor...said surface photovoltage sensor of said head assembly located within said sealed chamber; a conveying apparatus conveying said wafer adjacent said voltage sensor of the head assembly under the head assembly during processing.

Therefore the presently amended claim is directed toward a processing system in which the wafers, in a processing environment, are moved below the head within a sealed chamber during processing.

Conversely, Kamieniecki discloses what is evidently a closed measurement container in which a wafer is placed under a SPV head. The device as shown does not move a wafer beneath the head in a processing environment. Instead the wafer is apparently removed from the processing line and placed in a measuring apparatus. In fact as the Office Action states in part:

[r]egarding claim 53, Kamieniecki discloses [see Fig. 17] an apparatus for making surface photovoltage measurements of a semiconductor comprising a sealed chamber (represented as enclosure 197) [see column 12 lines 15-19] for processing the semiconductor wafer. However, Kamieniecki et al do not disclose a conveying apparatus as claimed.

Yoshino discloses a SPV measuring device in which a wafer is placed under a head and moved about causing relative motion between the surface and the head once the wafer is beneath the head. Apparently in the Yoshino device the head is smaller than the wafer and in order to scan the entire wafer, the wafer and the head must be moved relative to each other. As the Office Action further states:

Yoshino et al disclose...a conveying apparatus (combination of Wafer Chuck and Moving Stage) conveying the wafer (Silicon Wafer) adjacent the voltage sensor (SPV Transducer). Further, Yoshino et al teach that the addition of conveying apparatus is advantageous because it moves the

wafer around so that the SPV sensor (transducer) is able to evaluate the dielectric breakdown of an oxide layer on the wafer.

The Office Action goes on to state:

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the apparatus of Kamieniecki et al by adding a conveying apparatus as taught by Yoshino et al in order to move the wafer around so that the SPV sensor (transducer) is able to evaluate the dielectric breakdown of the wafer.

Finally, regarding Yoshino, the Office Action concludes:

It is inherent to bring the wafer beneath the head since in order to remove the wafer from the wafer chuck after evaluation, one of ordinary skill in the art would use the computer to control the stepping motor control drive to move the moving stage away from the head in order to remove one wafer to evaluate another wafer.

Applicants submit that as amended, claims 53-57 overcome this basis of rejection. The Kamieniecki reference discloses only a single head in a sealed chamber with no conveying apparatus. The Yoshino reference discloses a wafer chuck and moving stage that move the wafer in various positions under the SPV sensor head once the wafer is on the stage. In both cited references, the wafer is loaded beneath the head and measured individually in a manner suitable only for low volume wafer measurements. The conveying apparatus as recited in claims 53-57 of the present invention makes Applicants' invention suitable for high volume production line measurements of wafer characteristics taken during processing, none of which is claimed or rendered obvious in the cited references, taken together or separately.

The Examiner states that it is "inherent" to modify Yoshino to bring the wafer beneath the head. Applicants respectfully disagree. This feature is not inherent because Yoshino does not teach or disclose how the wafer is placed on the moving stage or underneath the SPV transducer. There are many ways in which this can take place, for example manually, or automatically in a

manner still unsuitable for in-process high volume production line measurements. Yoshino does not teach or disclose an in-process measuring device in which wafers are conveyed under the head assembly during processing.

Even if Yoshino were modified to “use the computer to control the stepping motor control drive to move the moving stage away from the head in order to remove one wafer to evaluate another wafer,” as suggested in the Office Action, process flow is still interrupted to remove the previously evaluated wafer. Yoshino does not teach moving the moving stage to allow in-process high volume wafer measurement. In other words, adjusting the moving stage to move the wafer away from the SPV Transducer in order to remove that wafer and physically replace it with another wafer is still an interruption of the process flow, and cannot occur in a processing environment. The present invention conveys the wafers under the head assembly during processing without interrupting process flow. This is not taught or disclosed by Kamieniecki or Yoshino, and is not rendered obvious by any combination thereof. While movement of the head relative to a single wafer for the limited purpose of wafer mapping may occur in Yoshino, neither Kamieniecki nor Yoshino teach to bring the wafer beneath the head in a processing environment for high volume, in-process, production line measurements taken during processing. Once the wafer has been brought beneath the head it may then be moved about for mapping purposes. However, neither Kamieniecki nor Yoshino teach an arrangement that permits the mapping of the wafer during wafer processing.

In the Office Action, the Examiner “noted that the features upon which applicant relies (i.e., wafers are moved under the head during processing) are not recited in the rejected claim(s).” The Examiner also stated “[a]lthough the claims are interpreted in light of the specification, limitations from the specification are not read into the claims.” By the present amendment,